REMARKS

Claims 1-8 are pending in the application. In the Office Action mailed November 14, 2009, claims 1-8 are rejected. In the instant Amendment, claims 1 has been amended to recite that the steel sheet has a microstructure composed of lower bainite or bainitic ferrite as a main phase which constitutes over 85% of the area of the microstructure. Support for the amendment to claim 1 is found in the specification as filed at p. 18, ll. 15-19.

No new matter has been added by the amendment. Entry of the foregoing amendment and consideration of the following remarks are respectfully requested.

Rejection under 35 U.S.C. § 112, second paragraph

Claims 1-8 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particular point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner contends that there is no guidance as to what amount of bainite or bainitic ferrite constitutes the "main phase." Applicants have amended claim 1 to recite that the steel sheet has a microstructure composed of lower bainite or bainitic ferrite as a main phase which constitutes over 85% of the area of the microstructure. The rejection is therefore obviated.

Rejections under 35 U.S.C. § 103(a)

Claims 1-4 are rejected under 35 U.S.C. §103(a) as being unpatentable over US 6,364,968 ("Yasuhara"). The Examiner contends that it would have been obvious to a person skilled in the art, at the time of the invention, to produce the claimed steel sheets because Yasuhara discloses thin hot-rolled steel sheets of an overlapping steel composition, produced by a substantially similar process, and having bainite as the main phase of not less than 90%.

As discussed in the previous response, a main object of the present invention is to provide a steel sheet for a frame of an automobile having good spot weldability (the specification at p. 1, ll. 28-34). The frame parts absorb impact at the time of collision and thereby function to protect the passengers. If the spot weld zone is not sufficient in strength, i.e., lowering CTS under a cross-joint tensile test caused by occurrence of expulsion and surface flash, at the time of collision, a sufficient collision energy absorption performance will not be able to be obtained.

If a high strength steel sheet is used, it is difficult to control current because of lowering expulsion and surface flash current. The contact area of the interface of the steel sheet is small and the current density is large at the time of the initial stage of the welding when strength is increased. In particular, regarding spot weldability, with a high-strength steel sheet, the weld zone strength falls. If welding by a welding current of the expulsion and surface flash region, the weld zone strength will remarkably drop or fluctuate. This problem is becoming a factor blocking expansion of the high-strength steel sheet market.

The present inventors have discovered the following for improving spot weldability caused by the expulsion and surface flash at the welding portions: 1) controlling the steel sheet composition by coexisting a high Si content, which conventionally was considered to deteriorate weldability, with Ti, Nb, Mo and B in appropriate contents for increasing TSS and CTS even in the region of occurrence of expulsion and surface flash; 2) specific amounts in the relationship among Ti, Nb, Mo and B, and Si, Mn; and 3) it is necessary to satisfy the equation: Ti, Nb, Mo and B as $1.1 \leq 14 \times Ti (\%) + 20 \times Nb (\%) + 3 \times Mo (\%) + 300 \times B (\%) \leq 3.7$, along with the specific amount of Si for improving weldability, because if the formula is less than 1.1, a high yield ratio is difficult to obtain and the weld strength also falls, whereas if the formula is over 3.7, the ductility. Further, it is necessary to gently control a hardness distribution at nugget and HAZ portions.

As a result, the present invention can achieve the maximum value of CTS when welding test pieces by a welding current of CE 10 times as "1", the maximum value of CTS when welding by a welding current of the region of occurrence of expulsion and surface flash: (CE + 1.5) KA is made 0.8 or more.

The application provides experimental data to demonstrate the importance of Ti, Nb, Mo and B on spot weldability. For example, steel E-1 contains Ti, Nb, Mo and B simultaneously (Table 1) and exhibits very good spot weldability (Table 2). On the other hand, steel E-2 does not contain Mo and B (Table 1) and exhibits poor spot weldability (Table 2).

In contrast, Yasuhara is not concerned with spot weldability. Yasuhara only requires one of Ti and Nb in its steels, Mo and B are both optional (Yasuhara, col. 7, ll. 34-61). With respect to Mo, Yasuhara teaches that it is one of a group of elements including Cu, Cr, Mo, and Ni, all of which are behave similarly regardless if they are added alone or in

combination with one or more others (Yasuhara, col. 7, l. 59 to col. 8, l. 9). None of the inventive examples of Yasuhara (Yasuhara Table 1) contains all of the four elements indispensible in the present invention. Nor does Yasuhara teach or suggest that these four elements must satisfy the recited compositional formula. In order to arrive at the presently claimed invention, a person skilled in the art would have to narrow the universe of steel compositions of Yasuhara by not only eliminating all steels not including all Ti, Nb, Mo, and B in the respectively recited amounts, but also selecting the proportions of these elements according to the recited formula. Given the fact that Yasuhara provides no indication that steels having the claimed characteristics are any different from any of its vast number of different steels, a person skilled in the art would not have been led by Yasuhara to the presently claimed invention. If a reference discloses a genus that contains a large number of variables, and the reference does not teach or suggest selecting the particular variable(s) so as to arrive at the claimed subgenus or species, the reference does not render the subgenus or species obvious. *In re Baird*, 16 F.3d 380; *In re Jones*, 958 F.2d 347 (Fed. Cir. 1992).

Furthermore, Yasuhara teaches away from the presently claimed invention by its disclosure that only one of Ti and Nb is required in its steels and that Mo and B are both optional, and by disclosing all examples which do not include all four elements. According to MPEP

> [s]imilarly, consider any teaching or suggestion in the reference of a preferred species or subgenus that is significantly different in structure from the claimed species or subgenus. Such a teaching may weigh against selecting the claimed species or subgenus and thus against a determination of obviousness. *Baird*, 16 F.3d at 382-83, 29 USPQ2d at 1552 (reversing obviousness rejection of species in view of large size of genus and disclosed "optimum" species which differed greatly from and were more complex than the claimed species); *Jones*, 958 F.2d at 350, 21 USPQ2d at 1943 (reversing obviousness rejection of novel dicamba salt with acyclic structure over broad prior art genus encompassing claimed salt, where disclosed examples of genus were dissimilar in structure, lacking an ether linkage or being cyclic). For example, teachings of preferred species of a complex nature within a disclosed genus may motivate an artisan of ordinary skill to make similar complex species and thus teach away from making simple species within the genus. *Baird*, 16 F.3d at 382, 29 USPQ2d at 1552. See also *Jones*, 958 F.2d at 350, 21 USPQ2d at 1943 (disclosed salts of genus held not sufficiently similar in structure to render claimed species *prima facie* obvious).

MPEP at 2100-157 (rev. 6, Sept. 2007). In this regard, Applicants respectfully submit that, as discussed above, experimental data disclosed in the present application shows that a steel such as steel E-2 that does not contain Mo and B exhibits poor spot weldability. This clearly demonstrates that the broad genus of steels of Yasuhara encompasses steels dissimilar in alloy compositions and spot weldability. By explicitly teaching that its steel does not have to contain one of Ti and Nb, and Mo and B, and providing all examples that do not contain all of the four elements, Yasuhara teaches away from the presently claimed steel requiring all four elements in the respectively recited amounts and in a proportion satisfying the recited proportional formula.

In the office action, the Examiner contends that there is no invention with respect to the compositional formula $1.1 \leq 14 \times Ti (\%) + 20 \times Nb (\%) + 3 \times Mo (\%) + 300 \times B (\%) \leq 3.7$ if it constitutes a discovery of a general formula which covers a composition that is disclosed in the prior art. The Examiner further contends that the selection of proportions of elements would require no more than routine investigation to select alloy compositions fulfilling the claimed compositional formula from the alloy compositional ranges disclosed by Yasuhara.

Applicants first respectfully submit that the compositional formula is not a general formula that covers any prior art composition, but further limits the amounts of Ti, Nb, Mo, and B within the respectfully recited ranges. Applicants further respectfully submit that "[a] particular parameter must first be recognized as a result-effective variable, *i.e.*, a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation." MPEP at p. 2100-152 (rev. 6, Sept. 2007). In the present case, the recited formula defines a relation of the amounts of Ti, Nb, Mo, and B, which must be satisfied to achieve a balance of high yield ratio and good ductility as well as to make the distribution of the hardness of the nuggets and HAZ (heat affected zone) smooth (the specification at p. 12, l. 29 to p. 13, l. 15). As discussed above, Yasuhara does not require that all of these elements be present in its steels, let alone recognizing that the proportions of these four elements affects yield ratio, ductility and weld zone. Therefore, the relation as defined in the formula is not recognized as a result-effective variable. A person skilled in the art would not have arrived at these equations by routine optimization.

Therefore, claims 1-4 are not obvious under 35 U.S.C. § 103(a) over

Yasuhara.

Claims 5 to 8 are rejected under 35 U.S.C. §103(a) as being unpatentable over Yasuhara in view of Marder, Vol. 20 of ASM Handbook (1997), pages 1 to 10.

As discussed in the previous response, Marder only discloses the common knowledge of hot dip coating. Marder does not disclose or suggest characteristic features of the relationship between the steel composition of the base steel sheet and spot weldability. Thus, Marder does not cure the deficiencies of Yasuhara.

Therefore, claims 5-8 are not obvious under 35 U.S.C. § 103(a) over Yasuhara in view of Marder.

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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